STUDY PROJECT

FAT OR FIT: IS THERE A CORRELATION?

BY

LIEUTENANT COLONEL STEVEN M. SAKUMA, FA

18 APRIL 1990

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* FAT OR FIT: IS THERE A CORRELATION?		5. TYPE OF REPORT & PERIOD COVERED Military Studies Project AY90
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) LTC Steven M. Sakuma		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S Army War College Carlisle Barracks, PA 17013		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army War College Carlisle Barracks, PA 17013		12. REPORT DATE 18 April 1990
		13. NUMBER OF PAGES 40
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Body fat, Physical Fitness, Overweight, Weight control System, Fat or Fit, Combat Readiness, Army, AWCP (JG)

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Army Regulation (AR) 600-9, The Army Weight Control Program, has undergone two major changes since all the military services were directed by Department of Defense (DOD) to design a weight control program. The current AR 600-9 requires the use of circumferential measurements to assess body fat percentages and states that the assurance of physical fitness and a trim military appearance are the primary objectives of this program. The hypothesis of this paper is that body fat percentage standards, as defined in AR 600-9, cannot accurately measure physical fitness. This paper will lay out the chronology of the Army Weight

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. Abstract (continued)

Control Program, provide research insight into current Army Regulations dealing with weight control and physical fitness, review the methodologies available to measure body composition, analyze current programs and provide recommendations to align weight control and physical fitness policy.

USAWC MILITARY STUDIES PROGRAM PAPER

FAT OR FIT: IS THERE A CORRELATION?

AN INDIVIDUAL STUDY PROJECT

by

Lieutenant Colonel Steven M. Sakuma, FA

Captain David A. Wright
Project Advisor

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013
18 April 1990

ABSTRACT

AUTHOR: Steven M. Sakuma, LTC, FA

TITLE: Fat or Fit: Is There a Corellation?

FORMAT: Individual Study Project

DATE: 18 April 1990 PAGES: 37 CLASSIFICATION: Unclassified

Army Regulation (AR) 600-9, The Army Weight Control Program, has undergone two major changes since all the military services were directed by Department of Defense (DoD) to design a weight control program. The current AR 600-9 requires the use of circumferential measurements to assess body fat percentages and states that the assurance of physical fitness and a trim military appearance are the primary objectives of this program. The hypothesis of this paper is that body fat percentage standards, as defined in AR 600-9, cannot accurately measure physical fitness. This paper will lay out the chronology of the Army Weight Control Program, provide research insight into current Army Regulations dealing with weight control and physical fitness, review the methodologies available to measure body composition, analyze current programs and provide recommendations to align weight control and physical fitness policy.

TABLE OF CONTENTS

FAT OR FIT: IS THERE A CORELLATION?

CHAPTER I

INTRODUCTION

"Physical fitness in the United States Army is the foundation of combat readiness and must be an integral part of every soldier's life. The readiness of the Army begins with the physical fitness of individual soldiers and the non-commissioned officers and officers who lead them."(1) This statement is the basis for policy guidance extracted from Army Regulation (AR) 350-15, The Army Physical Fitness Program. No one can argue the issue that the soldiers within the Army must maintain a certain level of physical fitness in order to ensure successful accomplishment of the assigned missions. The issue that is often debated is what standards of measurement should the Army use to determine this prescribed level of fitness? Physical fitness has numerous facets, each of which can be measured by a number of different standards. The hypothesis of this paper is that body fat percentage standards, as defined in AR 600-9, The Army Weight Control Program, cannot accurately measure physical fitness. The historical evolution of the Army Weight Control Program (AWCP), the methods available to measure body fat, an analysis of the current AWCP, and

recommendations for strengthening the AWCP and the Army Physical Fitness Program will be presented.

CHAPTER II

HISTORICAL SETTING

Throughout the long, proud history of the United States Army, the issue of physical fitness has continuously surfaced, but not always in the same setting. During times of world war, the rock-hard soldier was characterized as a rough and muscular individual with a cigarrette dangling from the corner of his mouth and a canteen full of whiskey on his hip. Then the Army suffered through the Vietnam years where smoking and drinking were still in vogue but there was an added dimension - drugs. Drug abuse quickly became the top visible program for the Army leadership, as well as the American public. Following the Vietnam war, the Army attempted to move toward a healthier and more physically fit Army. The period between 1973 and 1980 was a time of great transition in the area of physical fitness. Alcohol became de-glamorized and there was a growing emphasis on pro-life fitness and an acceptable military appearance. The Army was, as were the other military services, making a valiant attempt to raise its stature in the eyes and minds of the American public. The "All-Volunteer Army" was upon us and we in the military services now had to deliver a product that the general public would buy and support.

On 29 June 1981, the Department of Defense Directive 1308.1

directed the military services to adopt the following physical fitness policy:

> Physical fitness is a vital component of combat readiness and is essential to the general health and well-being of armed forces personnel. Individual service members must possess the stamina and strength to perform successfully any potential mission. These qualities, together with weight control, form the basis of the DoD physical fitness program.(2)

In order to execute this policy the military services were tasked to accomplish the following:

> (1)Physical Fitness: Military Services shall design and implement physical fitness programs, consistent with the established principles of physical conditioning. These programs may be tailored to suit the particular needs and mission of each Service.
>
> (2)Weight Control: To provide standards that enhance the attainment and retention of good health, physical fitness, and a trim military appearance. The determining factor in deciding whether a service member is overweight is the member's percent of body fat. Military Services shall determine body composition and fat standards

consistent with the mission of the Services. Standards shall be evaluated for consistency with health-fat relationships.(3)

Prior to this directive, the AWCP used height-weight standards as a screening process for identifying overweight soldiers. These standards were developed from the Metropolitan Life Insurance actuary data. As stated by Dr. Jerome Singer in an interview regarding height-weight tables, "I don't think they are very good because they are based on norms. Who is to say the norms are right. The preponderance of our society is heavy."(4) Height-weight tables suffer from many deficiencies. The common problem, though, is their inability to differentiate between an overweight state that is due to either an abundance of muscle or excess fat. Following DoD Directive 1308.1, the Army published the AWCP policy in the form of a change to AR 600-9, effective 15 April 1983. Based upon guidance from Department of the Army, the U.S. Army Research Institute of Environmental Medicine conducted a study upon which the changes to AR 600-9 were prosecuted. In part, the following points are the main findings of that study:

3. Prior to the 1983 revision, "an overweight condition existed when an individual's body weight exceeded the maximum allowable weight standard set forth in the

appendix." In the revised regulation, "an individual is considered overweight when his or her percent body fat exceeds the standard specified in paragraph 19c..."

4. The Army chose to estimate body fat by using the skinfold caliper technique in conjunction with the regression equations of Durnin and Womersley. (British Journal of Nutrition, 32: 77-97, 1974)

7. Personnel who exceed the body fat standards and exhibit no clinical cause for obesity will have their records flagged and will be placed in a supervised weight control program.

9. Unsatisfactory progress in a weight control program is grounds for separation proceedings.(5)

This measured distinction between muscular and fat soldiers gave teeth to the AWCP. However, it soon became evident that there was a great deal of variability between U.S. Army selected and trained observers, based upon a considerable range in the quality of the measurements using the caliper method. The Army concluded that an alternative method must be found, and in the course of discussion, their priority became clarification and interpretation of the tasking. This resulted in the following criteria being developed as the desirable features of a new system:

a) contains no skinfold measurements,

b) emphasizes circumference measures at easily locatable anatomic sites,

c) not to exceed 4 measurements (excluding height and weight),

d) able to be executed by non-technically trained personnel,

e) does not require elaborate or unavailable equipment,

f) common equation for all race/ethnic groups,

g) measurements should be avoided that require undressing beyond the Army sport ensemble,

h) selected equations must have a correlation coefficient of at least 0.80 with hydrostatically determined percent, body fat, and a standard error of the estimate not greater than 4.0% body fat, and

i) equations should give comparable results in the three major race/ethnic groups.(6)

The results of the study conducted by the U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts, issued the following conclusion:

> Taking into account the limitations and conditions that exist in the Army's program to screen for body fat, it is concluded that these new circumference based equations are superior to the previous D-W skinfold equations in

both practical and technical terms. The circumference procedure nevertheless suffers from the same limitations as all indirect anthropometry derived procedures and still fails to accurately estimate body fat in a limited number of cases. Thus, this method is not foolproof but rather is a screening tool to help the unit commander differentiate between over-fatness and over-muscularity.(7)

This brings us to the current regulation that governs the AWCP.

CHAPTER III

REVIEW OF ARMY REGULATIONS

The rhetoric that follows by no means represents an indepth research of current Army Regulations. What follows are some inconsistencies and shortcomings that I have found in some of the current regulations governing physical fitness and weight control. I have lifted portions of different regulations and followed the quotes with a narrative that explains what I believe to be policy inconsistencies in the arena of physical fitness and weight control.

AR 350-15, the Army Physical Fitness Program.

9d. Special programs are appropriate for soldiers who have difficulty meeting unit or Army standards. Such programs will not be punitive in nature; they must be designed to build up soldiers, not tear them down. (Additional conditioning is not a substitute for smart, tailored conditioning.) Special programs will also be designed to meet individual needs and to overcome specific weaknesses (such as aerobic or strength deficiency). In addition, they should encourage healthy lifestyle behavior.

9e. Special physical fitness programs will be tailored according to FM 21-20 and kept separate and distinct from the Army Body Composition/Weight Control Program,

except for the exercise programs prescribed to assist soldiers with weight control problems. It is intended that commanders avoid placing all soldiers that exceed body fat standards or have fitness problems into the same category with the expectation that more exercise will automatically result in decreased body fat. A soldier who exceeds body fat standards may be able to pass the Army Physical Fitness Test (APFT), while a very thin soldier may be unable to pass the APFT. One special program for both soldiers is obviously not appropriate. Special programs will be employed to the greatest extent possible for soldiers with physical fitness problems but will not be used to discipline soldiers who may have attitude problems toward physical exercise.(8)

The results of AR 350-15 defining physical fitness as having the appropriate amounts of fat and lean tissue as a component on one hand, and then on the other directs you to keep special physical fitness programs separate from the AWCP, is desultory logic. It is apparent the Army finds it difficult to, or has not conducted the research necessary, to draw a correlation between body fat percentage and physical fitness. Regulations and policies must be consistent to support soldiers who must abide by them and leaders who must objectively prosecute what is published.

AR 600-9, The Army Weight Control Program.

4a. The primary objective of the Army Weight Control Program is to ensure that all personnel-

(1) Are able to meet the physical demands of their duties under combat conditions.

(2) Present a trim military appearance at all times.

4c. Objectives of the Army Weight Control Program are to-

(1) Assist in establishing and maintaining-

(a) Discipline.

(b) Operational readiness.

(c) Optimal physical fitness.

(d) Health.

(e) Effectiveness of Army personnel through proper weight control.

211. Inherent in the responsibility of selection boards is the obligation to select only those individuals who are considered to be physically fit to perform the duties required of them at all times. Compliance with the Army Weight Control Program as prescribed in this regulation will be considered in the selection process for promotion, professional military or civilian schooling, or assignment to command positions.(9)

Considerable effort has been expended to develop methods for

measuring the body composition of individuals, but very little research has focused on the relationship between body composition and individual performance. There are several questions that beg to be asked. For instance, what is the ideal combination of fat and fat-free mass for optimum performance in different task-related functions? What are the implications of weight control practices for immediate and long-term health?

A primary concern that the Army should have is for the development of the ideal percentage of body fat for a given set of physical criteria - Military Occupational Specialty (MOS) related or unit specific. The use of the word "ideal", although being the choice of most policy-makers, implies that the ideal relative fat content for peak performance and long term health is known, but this is not true. The body fat percentages that the Army uses as a standard are based on measured norms of a specific population most likely to match that of any individual within the Army. The exact role of body composition for optimum performance has not been researched extensively, but the Army states this as a major component to physical fitness and measures an individual's potential for continued service based upon this standard.

AR 623-105, Officer Evaluation Reporting System.

Paragraph 4-13.1.

a.The rated officer will enter (typed)....the height and weight data in part IVa, item 12

c.(4)The rater will comment on an entry of "yes" when an officer exceeds the weight for height screening table limit but through a body fat examination is determined to be in compliance with the body fat standards of AR 600-9. The rater will enter the following statement in Part IVb:(a.12) "Meets body fat standard of AR 600-9."(10)

DA Circular 623-88-1, Noncommissioned Officer Evaluation Reporting System.

Paragraph 6-13.

a. The rater will enter the rated NCO's verified height and weight (in inches and pounds) as of the rater's signature date and an entry of "yes" or "no" to indicate compliance or noncompliance with the provisions of AR 600-9.

b. Rater specific bullet examples are mandatory in part IVc for the following:(3) to explain the basis for a "yes" entry when an individual exceeds the weight for height screening table limit but through a body fat determination is in compliance with the body fat standards of AR 600-9.(11)

Although the height-weight index is not the standard against which soldiers are measured for retention, it becomes the standard used by selection and promotion boards to determine

if individuals meet the "optimum criteria/standard", regardless of whether an individual meets the AWCP standard or not. If the Army has accepted the body fat percentage as the standard for retention and promotion, this is what should be entered on all evaluation reports.

AR 640-30, Photographs for Military Personnel Files.

5. Photographs are an important part of military personnel files. They are of particular interest to DA selection boards and career management activities.

7. (1)Male Personnel. Army green uniform with basic branch insignia, all permanently authorized ribbons, badges, and tabs correctly displayed. (2)Female Personnel. "Class A" Army Green Uniform (coat and skirt), The Army Green Pantsuit Uniform (jacket and slacks), of the Army Green Classic Uniform (coat and slacks/skirt) with basic branch insignia, all permanently authorized ribbons, badges, and tabs correctly displayed.(12)

Currently, official Department of the Army photographs are required in Class A uniforms only. If the Army is serious about having a fit, not fat, Army, an argument could be made to add the requirement for a full length photograph taken in the standard physical training uniform (shorts and T-shirt) from

three different angles - front, side and back. Photographs of the body, especially when taken in a standard position and with minimum clothing, can reveal a realistic evaluation of physique. This would provide Department of the Army selection and promotion boards with a true visual comparison between a numerical body fat percentage, on paper, and actual individual physique.

CHAPTER IV

BODY FAT MEASUREMENT METHODS

Few body composition assessments have ever been conducted directly. A direct analysis can only be performed on a cadaver, where the different body tissues can be carefully dissected. This requires a tremendous amount of time and effort, and cadavers are not easy to obtain. Furthermore, of what value is the assessment to the cadaver? Because of the problems associated with direct analysis and the relatively limited use of the resulting data, a number of indirect techniques have been developed to provide an estimate of the body's composition in the living human. In the evaluation of physique, the body can be described systematically, measured accurately, and quantified as to its gross components by physical and biochemical techniques. It is possible not only to follow standardized procedures in the course of linear and girth measurement but one has recourse to data on varied and sizeable populations. It is now possible to determine in the living person total amounts of blood, water, potassium and other electrolytes that previously were deduced from analysis of animal carcasses. Selected examples are further defined and referenced in the following paragraphs.

Weight for height indices: used in a variety of forms

to indicate adiposity. By this method, a very simple measurement of height is used to estimate body fat.(13)

Body Mass Index (BMI): weight in kilograms divided by the square of height in meters. Another simplistic approach to estimate overweight by computing a height/weight correlation.(14)

Waist-to-Hip ratio: relative measurements that give a numerical indication of physique. This ratio was shown to have significant relation to the incidence of stroke and ischaemic disease.(15)

Skinfold measurements: the accuracy of body composition estimates from regression equations depends on securing accurate measures of subcutaneous fat. Accuracy is enhanced by using a research-grade caliper and having a trained technician measure subcutaneous fat at the proper locations.(16)

Girth measurements: taken by means of an anthropometric steel tape. Girth measurements commonly recorded include: neck, chest, waist, thigh, calf, arm, and forearm. It would be possible to take other girth measurements, but these are most commonly used because they reflect changes that may occur as a result of growth, development as a result of activity, and atrophy as a result of inactivity.(17)

Hydrostatic weighing: fat has a lower density than lean tissue, therefore, relatively fat subjects will have a lower overall density. Thus, a measure of body volume in relation

to total body mass will measure body density and an estimate of the proportion of fat to lean tissue can be established.(18)

Visual estimation: estimation of body fat from photography. Although the accuracy is immediately suspect, it has been suggested that a well-trained individual could question any apparent discrepancy between measured and observed body fat.(19)

Arm Radiographic Assessment: conversion of six widths of fat, measured on a roentgenogram of the upper arm, to an estimate of body fat. The conversion to body fat from the x-ray widths was based on the inherent relationship established in the early 1920s between an external layer of fatness, surface area, and a constant.(20)

Bioelectrical Impedence Assessment: the transmission of an electrical signal in fat-free tissue greatly exceeds its conductance in fatty tissues. It can be shown that conductance in the total body volume is directly related to the concentration of salt ions in the conductor. Because fat tissue has almost no conducting properties, and fat-free tissues do, conductance is naturally greater in the fat-free tissues than in the fat mass.(21)

Nuclear Magnetic Resonance (NMR): has not been widely applied to body-composition research, but shows promise in this area. The physical basis for this method is the interaction of nuclei that have magnetic properties with an external magnetic field and an oscillating electromagnetic signal. Following

electromagnetic irradiation, the selected nuclei absorb and release energy at a particular frequency, a process referred to as resonance. The resonancefrequency characteristics describe the nuclear magnetic moment, motion, and environment. The NMR image is created from the magnetic resonance signals.(22)

Ultrasonography: the basic ultrasonic instrument transmits and receives a narrow beam of sound waves. The variable echogenicity of different tissues then permits calculation of the thickness of structures traversed by the sound beam. The subcutaneous fat-layer thickness and myocardial muscle-wall thicknesses are dimensions regularly established by ultrasonography.(23)

Fat-soluble Gases: the degree of absorption by the body of inert gases which are more soluble in fat than in water has been used to determine total body fat.(24)

Creatinine Excretion: 24-hour urinary creatinine excretion is the most widely used biochemical marker for estimation of body muscle mass. The basis for this measurement is that creatinine is the only metabolite of creatine which is largely located in muscle (98% of the body creatine pool).(25)

3-Methylhistidine: is an amino acid that is present almost exclusively in myofibrilar protein. During catabolism the released 3-methylhistidine is neither recycled for protein synthesis nor metabolised further, but is excreted in the urine. Muscle protein synthesis and degradation should be balanced

processes during steady-state periods, and thus daily urinary 3-methylhistidine excretion should be proportional to muscle mass in adult humans.(26)

Total Body Water: is an intake of a known amount of a substance and the determination of its concentration in the plasma or other body fluids after allowing time for equilibrium to be established within the body. Deuterium oxide is the method of choice.(27)

Total Body Potassium: is an indication of cellular or lean tissue mass because more than 90% of the potassium is within non-fat cells. The estimate of body fat is based on a constant fraction (0.012% of total body potassium) of 40K, a naturally-occurring radioisotope in non-fat tissue.(28)

Neutron Activation Analysis: irradiate the patient with fast neutrons and after placement in a whole-body radiation counter, measure the radioactivity induced in the body by the neutrons. The resulting spectrum of emitted gamma-rays can be analysed to determine a variety of total- body elements including chlorine, potassium, phosphorus and calcium.(29)

Total Body Carbon: carbon content of the body is a measure of its energy store. Because the body's principal energy store is fat, total-body carbon can estimate fat content.(30)

Photon Absorptiometry: the determination of body composition in specific parts of the body can be achieved by the attenuation of x-rays and gamma-rays. It can either involve

a single energy transmission when two clearly defined tissues are involved, or a dual energy system when variable thicknesses, such as the trunk, are involved.(31)

Multiple Isotope Dilution: permits the assessment of red cell mass, extracellular water volume, total body water and plasma volume.(32)

Computed Tomography: produces a cross-sectional image of the distribution of x-ray attenuation, or transmission.(33)

Total-Body Electrical Conductivity: operates on the principle that an object placed in an electromagnetic field will perturb the field, and the degree of perturbation is dependent on the quantity of conducting material present. The electrolytes present in lean body mass account for almost all of the electrical conductivity, therefore the total-body electrical conductivity value should relate closely to lean body mass.(34)

Infrared Interactance: the degree of infrared energy absorption is related to the composition of the substance through which the energy is passing and the particular wavelength of the energy. The absorption factor is determined by the amount of resultant transmitted or reflected energy.(35)

In the last 30 years, at least 100 prediction methods have been proposed to evaluate the fat and lean components of the body. Most authors usually point out that validity is disappointingly poor when prediction equations and formulae

are applied to independent samples. While the prediction of mean values is relatively high, prediction of body composition for an individual subject is much more variable. Of utmost concern is this question, "Should prediction equations be used, and if yes, what is their accuracy?" My research has led me to conclude that there are numerous ways to measure body fat percentages and the Army's choice for methodology is no more or no less accurate than any of the aforementioned methods. However, one may conclude that definitive procedures for assessment of body build are available for application in the field of exercise physiology. Although each aforementioned method measures body composition, the real issue is not methodology, but rather; what does the data mean? The Army has developed a norm and according to their research, it accurately defines the standard of the general population of the Army. The contentious issue is, does it have any correlation to an acceptable physical fitness level and/or an acceptable appearance standard?

CHAPTER V

CONCLUSION

My original hypothesis that it is erroneous to use body fat percentage standards as a measurement of personal fitness remains a valid statement. A review of AR 600-9, has clearly surfaced two objectives for the Army. Establish (1) a fitness standard and, (2) an appearance standard using body fat percentage as the standard measurement. Based upon my review of the many studies that have been conducted on the best way to measure body composition, specifically body fat, I have concluded that the circumferential system meets the validity and reliability criteria that have been accepted by the majority of the American public and has stood the test of time and many Congressional inquiries. Although there are methods that are more accurate, the current system is the most consistent and objective, considering the population with which the Army must deal. Although not totally fool-proof, the current body fat standard is an acceptable evaluation for appearance. However, my research has uncovered no publications or references that have established a consistent correlation between body fat measurement and levels of personal fitness, for either an individual or a like grouping of U.S. Army soldiers. Based upon this finding, my research process has uncovered areas of

additional study. I have incorporated these areas into my recommendations. I am not unequivocally stating that the system is broken, but I am saying that we in the Army are now facing an opportunity to establish a totally objective fitness standard that we can apply to all members of the Army. This standard will enable our future senior leaders to enter any situation, combat or peace, with the assurance of having a force that not only looks physically fit, but also has the physical capability to accomplish any assigned or implied task.

CHAPTER VI

RECOMMENDATIONS

My research has led me to the following recommendations (which include areas that require additional study):

1. Revise AR 600-9 to provide separate standards for physical fitness and appearance. The thrust of this revision should be to dilineate body fat percentage as an appearance criteria and not a physical fitness standard.

2. Revise AR 623-105 and DA Circular 623-88-1 to eliminate the use of the height/weight index as an entry on the officer and noncommissioned officer efficiency report. The standard should be "does the rated individual meet the body fat percentage IAW AR 600-9".

3. Revise AR 640-30 to include the requirement to be photographed in the Army physical training uniform (shorts and T-shirt) in the three basic somatotype poses; front, side and back. These photographs should be part of the officers' and NCOs' official file, and should be updated IAW the current regulation.

4. Align all the military services' weight control programs at the DoD level, using DoD Directive 1308.1. The vehicle for this is the Physical Fitness Committee formed by DoD Directive 1308.2. The DoD policy should be directed at appearance and policy guidelines should be consistent across the services.

5. Initiate a longitudinal study that pulls together all the current research agencies within DoD (specifically available to the U.S. Army), to assess the standards for physical fitness from initial entry through retirement. Soldiers of all categories should be tracked from accession to retirement, using the opportunities that currently exist, i.e., Military Entrance Processing Stations (MEPS), Basic and Advanced Schools, Primary Leadership Development Courses, Basic and Advanced NCO courses, Officer Advanced courses, CAS3, Command General Staff College, Sergeant Majors Academy, Senior Service Schools, Joint Readiness Training Center and the National Training Center. The objective is to develop and validate an objective criteria that measures physical fitness capability of individuals. This criterion must be individual specific, MOS specific, unit specific or a combination of these; but ultimately contribute to the combat readiness measurement. Refer to enclosure 1.

6. Task the Commandant, U.S. Army War College, to coordinate the efforts of the longitudinal study and to have oversight requirements, in conjunction with the Soldier Physical Fitness Center, at Fort Benjamin Harrison, Indiana.

ENDNOTES

1. U.S. Department of the Army, Army Regulation 350-15, p4.

2. U.S. Department of Defense, Department of Defense Directive 1308.1, p1.

3. Ibid., p encl 2.

4. Interview with Dr Jerome Singer, Chairman of the Medical Psychology Department at Uniformed Services University, Bethesda, 23 January 1990.

5. Fitzgerald, Patricia I., et.al., US Army Research Institute of Environmental Medicine Report T5-87, pp3-4.

6. Vogel, J.A., et.al., US Army Research Institute of Environmental Medicine Report 17-88, p6.

7. Ibid., p16.

8. AR 350-15, p4.

9. U.S. Department of the Army, Army Regulation 600-9, p3 and 5.

10. U.S. Department of the Army, Army Regulation 623-105, p15.

11. U.S. Department of the Army, Department of the Army Circular 623-88-1, p18.

12. U.S. Department of the Army, Army Regulation 640-30, p3.

13. D.A. Brodie, "Techniques of Measurement of Body Composition-Part I", Sports Medicine, vol 5, 1988, p28.

14. U.S. Department of Health and Human Services, Promoting Health/Preventing Disease: Year 2000 Objectives for the Nation (Draft), p1-9.

15. Brodie, p30.

16. Ted A. Baumgartner and Andrew S. Jackson, Measurement for Evaluation in Physical Education and Exercise Science, p251.

17. Frank D. Sills, Structural and Physiological Aspects of Exercise and Sports, p26.

18. Brodie, p25.

19. Brodie, p30.

20. Ross Laboratories, Report of the Sixth Ross Conference on Medical Research, p46.

21. Ibid., p49.

22. Ibid., p56.

23. Ibid.

24. Brodie, p31.

25. Brodie, p31.

26. Brodie, p32.

27. Brodie, p33.

28. Brodie, p36.

29. Brodie, p37.

30. Brodie, p38.

31. Brodie, p38.

32. Brodie, p39.

33. Brodie, p75.

34. Brodie, p83.

35. Brodie, p86.

APPENDIX A

REGULATION BIBLIOGRAPHY

1. US Department of Defense. Department of Defense Directive 1308.1: Physical Fitness and Weight Control Program. Washington: 29 June 1981, C1, 15 January 1987.

2. US Department of Defense. Department of Defense Directive 1308.2: Joint DoD Committee on Fitness. Washington: 25 January 1985.

3. US Department of the Army. Army Regulation 350-15: The Army Physical Fitness Program. Washington: 4 December 1989.

4. US Department of the Army. Army Regulation 600-9: The Army Weight Control Program. Washington: 1 October 1986.

5. US Department of the Army. Army Regulation 623-105: Officer Evaluation Reporting System. Washington: 15 November 1981, C11 Update, 1 March 1988.

6. US Department of the Army. Army Regulation 640-30: Photographs for Military Personnel Files. Washington: 16 October 1985, C1, 21 April 1986.

7. US Department of the Army. Department of Army Circular 623-88-1: Noncommissioned Officer Evaluation Reporting System. Washington: 1 February 1988.

APPENDIX B

REPORT BIBLIOGRAPHY

1. Naval Medical Research and Development Command. Naval Health Research Center Report No 84-11: Prediction of Percent Body Fat for US Navy Men From Body Circumferences and Height. San Diego: March 1984.

2. Naval Medical Research and Development Command. Naval Health Research Center Report No 84-29: Prediction of Percent Body Fat for US Navy Women from Body Circumferences and Height. San Diego: June 1984.

3. Naval Medical Research and Development Command. Naval Health Research Center Report No 84-39: Techniques for Measuring Body Circumferences and Skinfold Thicknesses. San Diego: August 1984.

4. Ross Laboratories. Report of the Sixth Ross Conference on Medical Research: Body Composition Assessments in Youth and Adults. Columbus: 1985.

5. United States Army Medical Research and Development Command. US Army Research Institute of Environmental Medicine Report T5-87: The Body Composition Project: A Summary Report and Descriptive Data. Natick: December 1986.

6. United States Army Medical Research and Development Command. US Army Research Institute of Environmental Medicine Report 17-88: Derivation of Anthropometry Based Body Fat Equations for the Army's Weight Control Program. Natick: May 1988.

7. US Department of Health and Human Services. Promoting Health/Preventing Disease: Year 2000 Objectives for the Nation (Draft): Goals for the Nation. Washington: September 1989.

APPENDIX C

BOOK BIBLIOGRAPHY

1. Baumgartner, Ted A. and Jackson, Andrew S. Measurement for Evaluation in Physical Education and Exercise Science. Iowa: Wm C. Brown, 1982, pp 14-16, 242-267.

2. Behnke, Albert R. Exercise Physiology. Edited by harold B. Falls. New York and London: Academic Press, 1968, pp 359-368.

3. Brozek, Josef. A Handbook of Anthropometry. Edited by M.F. Ashley Montagu. Illinois: Charles C. Thomas, 1960, pp 78-115.

4. Buddin, Richard. Weight Problems and Attrition of High Quality Military Recruits. Santa Monica: Rand Corp, June 1989, pp 1-24.

5. Fox, Samuel M. III, Pollack, Michael L. and Wilmore, Jack H. Exercise in Health and Disease. WB Saunders Co, 1984, pp 215-241.

6. Getchell, Bud. The Fitness Book. Indiana: Benchmark Press, 1987, pp 143-159.

7. Marfell-Jones, M.J. and Ross, W.D. Physiological Testing of the Elite Athlete. Edited by J. Duncan MacDougall, Howard A. Wenger and Howard J. Green. Canadian Association of Sport Sciences, 1982, pp 75-104.

8. McArdle, William D., Katch, Frank I. and Katch, Victor L. Exercise Physiology: Energy, Nutrition, and Human Performance. Philadelphia: Lee and Febiger, 1981, pp 386-388.

9. Sheldon, W.H., Stevens, S.S. and Tucker, W.B. The Varieties of Human Physique. NY and London: Harper and Brothers, 1940, pp 4-47.

10. Sills, Frank D. Structural and Physiological Aspects of Exercise and Sport. Edited by Warren R. Johnson and E.R. Buskirk. NJ: Princeton Book Co, 1980, pp 24-30.

11. Sinning, Wayne E. The Academy Papers: Limits of Human Performance. Edited by David H. Clarke and Helen M. Eckert. Champaigne: Human Kinetics, 1985, pp 45-56.

12. Wilmore, Jack H. Training for Sport and Activity the Physiological Basis of the Conditioning Process. Boston, London, Sydney, Toronto: Allyn and Bacon 1982, pp 119-136.

APPENDIX D

PERIODICAL BIBLIOGRAPHY

1. Berg, Kris E.; Hutcheson, Lonn; Latin, Richard W.; Prentice, Earnest, "Body Impedance Analysis and Body Water Loss." Research Quarterly, Vol 59, no 4, 1988, pp 359-362.

2. Boilear, Richard A.; Bunt, Joy C.; Lohman, Timothy G., "Impact of Total body water fluctuations on estimation of body fat from body density." Medicine and Science in Sports and Exercise, vol 21, no 1, 1989, pp 96-100.

3. Brodie, D.A., "Techniques of Measurement of Body Composition Part I". Sports Medicine, vol 5, 1988, pp 12-40, 74-88.

4. Bulbulian, Ronald, "The influence of somatotype on anthropometric prediction of body composition in young women". Medicine and Science in Sports and Exercise, vol 16, no 4, 1984, pp 389-396.

5. Burse, Richard L.; Knapik, Joseph S.; Vogel, James A., "Height, Weight, PerfectBody Fat, and Indices of Adiposity for Young Men and Women Entering the US Army". Aviation, Space, and Environmental Medicine, March 1983, pp 223-229.

6. Buskirk, Elsworth; Mendez, Jose, "Sports science and body composition analysis: emphasis on cell and muscle mass". Medicine and Science in Sports and Exercise, vol 16, no 4, 1984, pp 584-593.

7. Clarys, J.P.; Martin, A.D.; Drinkwater, D.T.; Marfell-Jones, M.J., "The Skinfold: myth and reality". Journal of Sports Science, no 5, 1987, pp 3-33.

8. Coffman, Jerry L.; Timson, Benjamin F., "Body Composition by hydrostatic weighing at total lung capacity and residual volume". Medicine and Science in Sports and Exercise, vol 16, no 4, 1984, pp 411-413.

9. Cureton, Kirk J., "A reaction to the manuscript of Jackson". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 621-622.

10. Damon, Albert and Goldman, R.F., "Predicting Fat from Body Measurements: Densitometric Validation of Ten Anthropometric Equations". Human Biology, February 1964, pp 16-19.

11. Jackson, Andrew S.; Pollock, Michael L., "Research progress in validation of clinical methods of assessing body composition". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 606-61

12. Jackson, Andrew S., "Research design and analysis of data procedures for predicting body density". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 616-620.

13. Katch, F.I. and Katch, V.L., "Measurement and Prediction Errors in Body Composition Assessment and the Search for the Perfect Prediction Equation". Research Quarterly for Exercise and Sport, March 1980, pp 249-255.

14. Katch, Victor L., "A reaction to laboratory methodology". Medicine and Science in sports and Exercise, vol 16, no 4, 1984, pp 604-605.

15. Lohman, Timothy G., "Preface to Body Composition Assessment: a reevaluation of our past and a look toward the future". Medicine and Science in Sports and Exercise, vol 16, no 4, 1984, p 578.

16. Lohman, Timothy G., "Research progress in validation of laboratory methods of assessing body composition". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 596-603.

17. Malina, Robert M., "Comments on clinical methods of assessing body composition". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 614-615.

18. Mansfield, Edward R. and Smith, Joe F., "Body composition prediction in university football players". Medicine and Science in Sports and Exercise, vol 18, no 4, 1984, pp 398-404.

19. Roche, Alex F., "Research progress in the field of body composition". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 579-583.

20. Tran, Rung Vu and Weltman, Arthur, "Generalized equation for predicting body density of women from girth measurements". Medicine and Science in Sports and Exercise, vol 21, no 1, 1989, pp 101-103.

21. Wilmore, Jack H., "A reaction to the manuscripts of Roche and Buskirk". Medicine and Science in Sports and Exercise, vol 16, no 6, 1984, pp 594-595.

APPENDIX E

INTERVIEW BIBLIOGRAPHY

1. Anapol, Beverly, LTC, ANC. Action Officer, Office of the Deputy Chief of Staff for Personnel, US Army. Personal Interview. Washington: 23 January 1990.

2. Getchell, Bud, PhD. Executive Director of the National Institute for Fitness and Sports. Personal Interview. Bloomington: 18 January 1990.

3. Singer, Jerome, MD. Chairman of the Medical Psychology Department at Uniformed Services University. Personal Interview. Bethesda: 23 January 1990.

APPENDIX F

Proposed Longitudinal Study

1. OBJECTIVE: To determine a common denominator to measure minimum acceptable levels of physical fitness.

2. SCOPE: There are numerous levels of study, depending on resources available. Also, there is a full spectrum of variables that could be captured at individual levels. At a minimum, data collected should include physical examination data, body fat percentages, strength testing, aerobic capacity testing and flexibility testing. Obviously, resources, such as time, money and facilities, will determine what kind and how much data is collected for each level of research. The following paragraph outlines the options available for the recommended research.

3. RESEARCH OPTIONS: (Refer to enclosure 1)

a. Level 1: (pre-entry and entry level)
(1) Gather data prior to accession: officer data at USMA and ROTC; and enlisted data at Military Entrance Processing Station (MEPS).
(2) Follow-up sample by gathering data at Officer Basic Courses (OBC) and One Station Unit Training (OSUT) and Basic and Advanced Individual Training.

b. Level 2: (0-4 years)
(1) Follow initial sample to first duty station.
(2) Priority to Cohesion Operational Readiness Training (COHORT) units.
(3) Measure individual, MOS specific and unit physical criteria.

c. Level 3: (4-5 years)
(1) Officer Advanced Course (OAC).
(2) Primary Leadership Development Course (PLDC) and Basic NCO Course (BNCOC).

d. Level 4: (6-12 years)
(1) Track the original sample to non-MOS specific units, i.e., recruiting command and drill sergeant duty.
(2) Evaluate unit specific tasks using opportunities such as Joint Readiness Training Center (JRTC) and National Training Center (NTC).

e. Level 5: (12-14 years)
(1) Command General Staff College (CGSC) and Advanced NCO Course (ANCOC) is a great target audience.
(2) Additionally, this is the time to lay the groundwork for health risk appraisals for service member and spouses.

f. Level 6: (15-18 years)

(1) Unit specific tasks aimed at the senior leaders from the initial sample; first sergeants, command sergeants major and battalion commanders.

(2) Evaluate fitness programs developed and executed by the senior leaders from initial sample.

g. Level 7: (19-22 years)

(1) Sergeants Major Academy (SMA) and Senior Service College (SSC) is a population at the over forty age category.

(2) This is an opportunity to develop data over the entire one year academic program.

h. Level 8: (22-30 years)

(1) Priority to Command Sergeants Major serving at General Officer command levels and General Officers.

(2) Pre-retirement assessments.

4. RESEARCH GUIDELINES.

a. The spectrum of research, as depicted at enclosure 1, can be either continuous (every 5 years from entrance through 30 years of service) or site specific (e.g., OBC and retirement).

b. There are numerous opportunities to gather data, as one can see at enclosure 1. However, I would recommend the following policy decisions.

(1) Require data collection at MEPS and correlate to data colection at OSUT.

(2) Require data collection at OAC, ANCOC, CGSC, SMA and SSC.

c. Priority data collection for COHORT units, because of the opportunity for a longer study of the same group.

5. CONCLUSION.

a. The Army has not studied, in total, the relationship between fitness indicators and levels of physical fitness.

b. There are definite targets of opportunity for data collection.

c. The Commandant, U.S. Army War College, has the structure necessary to initiate this study.

d. Total readiness will be increased considerably if criteria can be developed for commanders to accurately and objectively assess fitness levels of individual service members.

Enclosure 1 to Appendix F: (Longitudinal Study Template)